

I claim:

1. A lead-free solder alloy selected from the group consisting of:
  - 5 (i) an alloy including at least about 90% Sn, 0.2 to 5.0% Cu, and 0.05 to 5.0% Bi;
  - (ii) an alloy including at least about 75% Sn, 0.5 to 7.0% Cu, 0.05 to 18% Sb;
  - 10 (iii) an alloy including at least about 67% Sn, 3 to 15% Ag, and 0.01 to 18% Sb;
  - (iv) an alloy including at least about 78% Sn, 0.8 to 7.0% Cu, and 4 to 15% Ag;
  - (v) an alloy including at least about 96% Sn, and at least one of 0.01 to 2.0% Ni, and 0.01 to 2.0% Co;
  - 15 (vi) an alloy including at least about 90% Sn, 0.05 to 5.0% Bi, and 0 to 5.0% Sb; and
  - (vii) an alloy including at least about 90% Sn, 0.2 to 0.9% Cu, and 0.1 to 5.0% Bi.
2. The lead-free solder alloy of claim 1 having a liquidus melting temperature greater than 215°C.
3. The lead-free solder alloy of claim 1, wherein the alloy is alloy (i) and includes about 90 to 99% Sn, 0.2 to 5.0% Cu, and 0.05 to 5.0% Bi.
4. The lead-free solder alloy of Claim 3, wherein the solder alloy composition comprises about 96.0% Sn, 3.0% Cu, and 1.0% Bi.
5. The lead-free solder alloy of claim 1, wherein the alloy is alloy (ii) and includes about 75 to 99% Sn, 0.5 to 7.0% Cu, and 0.05 to 18% Sb.
6. The lead-free solder alloy of Claim 5, wherein the solder alloy composition comprises about 82% Sn, 3% Cu, and 15% Sb.

7. The lead-free solder alloy of claim 1, wherein the alloy is alloy (iii) and includes about 67 to 97% Sn, 3 to 15% Ag, and 0.01 to 18% Sb.

8. The lead-free solder alloy of Claim 7, wherein the solder alloy composition comprises about 75% Sn, 10% Ag, and 15% Sb.

9. The lead-free solder alloy of Claim 7, wherein the solder alloy composition comprises about 93.5% Sn, 5% Ag, and 1.5% Sb.

10. The lead-free solder alloy of claim 1, wherein the alloy is alloy (iv) and includes about 78 to 96% Sn, 0.8 to 7.0% Cu, and 4 to 15% Ag.

11. The lead-free solder alloy of Claim 10, wherein the solder alloy composition comprises about 87% Sn, 3% Cu, and 10% Ag.

12. The lead-free solder alloy of claim 1, wherein the alloy is alloy (v) and includes about 96 to 99% Sn, and at least one of 0.01 to 2.0% Ni, and 0.01 to 2% Co.

13. The lead-free solder alloy of Claim 12, wherein the solder alloy composition comprises about 99.3% Sn, 0.2% Ni, and 0.5% Co.

14. The lead-free solder alloy of claim 1, wherein the alloy is alloy (vi) and includes about 90 to 99% Sn, 0.05 to 5.0% Bi, and 0 to 5.0% Sb.

15. The lead-free solder alloy of Claim 14, wherein the solder alloy composition comprises about 98.5% Sn, 1% Bi, and 0.5% Sb.

16. The lead-free solder alloy of claim 1, wherein the alloy is alloy (vii) and includes about 90 to 99% Sn, 0.2 to 0.9% Cu, and 0.1 to 5.0% Bi.

17. The lead-free solder alloy of claim 16, wherein the solder alloy composition comprises about 98.3% Sn, 0.7% Cu, and 1% Bi.

18. The lead-free solder alloy of claim 16, wherein the solder alloy exhibits a tensile strength and fatigue life at 0.2% strain greater than a Sn/Cu eutectic composition of 99.3Sn/0.7Cu.